1. Introduction

Alzheimer's disease is defined (National Institute of Neurological Disorders and Stroke) as "an age-related, non-reversible brain disorder that develops over a period of years. Initially, people experience memory loss and confusion, which may be mistaken for the kinds of memory changes that are sometimes associated with normal aging. However, the symptoms of AD (Alzheimer's Disease) gradually lead to behavior and personality changes, a decline in cognitive abilities such as decision-making and language skills, and problems recognizing family and friends. AD ultimately leads to a severe loss of mental function. These losses are related to the worsening breakdown of the connections between certain neurons in the brain and their eventual death. AD is one of a group of disorders called *dementias* that are characterized by cognitive and behavioral problems. It is the most common cause of dementia among people age 65 and older".

Three important hallmarks have been identified in the brain that is associated with the disease processes of Alzheimer's disease.

- **Amyloid plaques**, which are made up of fragments of a protein called beta-amyloid peptide mixed with a collection of additional proteins, remnants of neurons, and bits and pieces of other nerve cells.
- **Neurofibrillary tangles (NFTs)**, found inside neurons, are abnormal collections of a protein called tau. Normal tau is required for healthy neurons. However, in AD, tau clumps together. As a result, neurons fail to function normally and eventually die.
- **Loss of connections between neurons responsible for memory and learning**. Neurons can't survive when they lose their connections to other

> neurons. As neurons die throughout the brain, the affected regions begin to atrophy, or shrink. By the final stage of AD, damage is widespread and brain tissue has shrunk significantly. (NINDS)

Alzheimer's disease is currently ranked as the sixth leading cause of death in the United States, but recent estimates indicate that the disorder may rank third, just behind heart disease and cancer, as a cause of death for older people.

Alzheimer's disease is the most common cause of dementia among older adults. Dementia is the loss of cognitive functioning—thinking, remembering, and reasoning—and behavioral abilities to such an extent that it interferes with a person's daily life and activities. Dementia ranges in severity from the mildest stage, when it is just beginning to affect a person's functioning, to the most severe stage, when the person must depend completely on others for basic activities of daily living.

The causes of dementia can vary, depending on the types of brain changes that may be taking place. Other dementias include Lewy body dementia, front temporal disorders, and vascular dementia. It is common for people to have mixed dementia—a combination of two or more disorders, at least one of which is dementia. For example, some people have both Alzheimer's disease and vascular dementia.

Alzheimer's disease is named after ***Dr. Alois Alzheimer.*** In 1906, Dr. Alzheimer noticed changes in the brain tissue of a woman who had died of an unusual mental illness. Her symptoms included memory loss, language problems, and unpredictable behavior. After she died, he examined her brain and found

many abnormal clumps (now called amyloid plaques) and tangled bundles of fibers (now called neurofibrillary, or tau, tangles).

These plaques and tangles in the brain are still considered some of the main features of Alzheimer's disease. Another feature is the loss of connections between nerve cells (neurons) in the brain. Neurons transmit messages between different parts of the brain, and from the brain to muscles and organs in the body. (National Institute on Aging)

Alzheimer disease is designated (Béatrice Duthey, 2013) "as the most common form of dementia". There are no available treatments that stop or reverse the progression of the disease, which worsens as it progresses, and eventually leads to death. There are currently no specific markers that can confirm with a 100% certainty AD diagnosis. A combination of brain imaging and clinical assessment checking for signs of memory impairment is used to identify patients with AD. Definitive diagnosis can only be only obtained after patients autopsy by examining brain tissues. There is a clear need for tangible advances in the area of biomarkers for assessment of risk, diagnosis and monitoring disease progression. Screening of patients still remains very expensive and new research is necessary to develop non expensive and reliable tests.

The report highlights an urgent need for increased and sustainable funding for dementia research. The global ratio of publications on neurodegenerative disorders, versus cancer, is an astonishing 1:12. Through this report Alzheimer's disease International is calling on governments to commit to a minimum of 1% of the societal cost of dementia to be dedicated to research. In 2018 the global societal cost is US$1 trillion. Alzheimer's disease has taken over from cancer to become America's most feared disease. It kills more people in the U S than breast

cancer and prostate cancer combined. It's now the number one killer in England and Wales. Alireza Atri is an internationally renowned cognitive neurologist and Director of the Banner Sun Health Research Institute and Senior Scientist with the Alzheimer's Prevention Initiative. He says "We were probably terribly naive to think a brain disorder like Alzheimer's disease would be simpler than any other human disorder". De Strooper led a team of 250 researchers at the KE Leuven in Belgium before moving to University College London, and becoming director of the research institute that was started as a result of a pledge coming out of the 2013 G8 summit, championed by the then British Prime Minister David Cameron and former French President Nicolas Sarkozy, to find a "disease-modifying treatment" for Alzheimer's by 2025. (World Alzheimer Report 2018)

2. Need for the study

The exponential growth of literature and rapid development of libraries generated several evolutionary studies about the effectiveness and efficiency of information services. These studies led to the identification and application of appropriate quantitative measuring techniques known as Scientometrics. Libraries and information scientists throughout the world use scientometric studies to throw light on the pattern of growth of literature, collaborative research, core journals interrelationship among different branches of knowledge, productivity and influence of authors, pattern of collection development, their use etc. Scientometric study of mapping of Alzheimer's disease research literature will provide an insight of the research being carried out in the country and helps in identifying the major indicators in the discipline. The review of literature reveals that there are several research studies have been conducted on Alzheimer disease in India and abroad. They are reflected in many journals at

national and international repute; projects and dissertations. But no comprehensive have been found leading to thesis. The researcher also traced the study in shodhaganga; shodhagangothri and electronic thesis and dissertations. Therefore the present study has been undertaken.

3. Objectives of the study

The main objectives of the study are to find out:

- Growth and trend of Alzheimer's disease literature.
- The applicability of selected growth models in the Alzheimer's disease literature.
- The cross national analysis; authorship pattern and collaboration at international level with the help of collaborative measures.
- The behavior of scientists and scientific productivity of institutions contributing to the Alzheimer's disease research.
- Thirst areas of Alzheimer's disease research and their progress.
- Channels of communications used by scientists.
- The h-index and g-index to quantify an individual's scientific research output.
- The language-wise distribution of publications.
- High impact of papers and their focus of research.
- The applicability of Bradford's Laws.
- Obsolescence of Alzheimer's disease literature.

4. Hypotheses

H1. The relative growth rate of Alzheimer's disease research literature shows an exponential trend.

H2. There is a growing collaboration in the field of Alzheimer's disease research literature.

H3. The Bradford's Law of Scattering goes well with medical journals.

5. Statement of the problem

The present research problem is conceived under the title "**MAPPING OF ALZHEIMER'S DISEASE RESEARCH LITERATURE: A SCIENTOMETRIC STUDY"**

6. Scope and limitation of the study

According to WHO report (2018) 56.9 million deaths worldwide in 2016, more than half (54%) were due to the top 10 causes. Ischemic heart disease and stroke are the world's biggest killers, accounting for a combined 15.2 million deaths in 2016. These diseases have remained the leading causes of death globally in the last 15 years. Chronic obstructive pulmonary disease claimed 3.0 million lives in 2016, while lung cancer (along with trachea and bronchus cancers) caused 1.7 million deaths. Diabetes killed 1.6 million people in 2016, up from less than 1 million in 2000. Deaths due to dementias (Alzheimer's disease) more than doubled between 2000 and 2016, making it the 5th leading cause of global deaths in 2016 compared to 14th in 2000.

The review of literature shows that several scientometric studies have been conducted on heart disease; chronic obstructive pulmonary disease; diabetes. As stated under need for the study, there are no scientometric studies have found on Alzheimer's disease. Therefore the proposed study has been undertaken.

The proposed study is confined to Alzheimer's disease based on the literature reported in Web of Science Database. The main focus of this study will be on research output in terms of publication reflected in the Web of Science Database during the period from 2001-2020.

7. Materials and methodology

The data for the study will be downloaded from Web of Science database. Web of Science (previously known as Web of Knowledge) is an online subscription-based scientific citation indexing service originally produced by the Institute for Scientific Information (ISI), later maintained by Clarivate Analytics (previously the Intellectual Property and Science Business of Thomson Reuters, that provides a comprehensive citation search. It gives access to multiple databases that reference cross-disciplinary research, which allows for in-depth exploration of specialized sub-fields within an academic or scientific discipline. Web of Science is described as a unifying research tool which enables the user to acquire, analyze, and disseminate database information in a timely manner. This is accomplished because of the creation of a common vocabulary, called ontology, for varied search terms and varied data. Moreover, search terms generate related information across categories. Acceptable content for Web of Science is determined by an evaluation and selection process based on the following criteria: impact, influence, timeliness, peer review, and geographic representation.

8. Review of related literature

The literature review is an integral part of academic writing. It is a critical and in depth evaluation of previous research. It is a summary and synopsis of a particular area of research, allowing anybody reading the paper to establish why pursuing particular research program. A good literature review expands upon the reasons behind selecting a particular research question and plays a very important role in the research process. A review becomes a source from where research ideas are drawn and developed into concepts and finally theories. It also provides the researcher a Bird's eye view about the research done in that area so far. The purpose of reviews has forced to educate as much information as

possible pertaining to the topic chosen. It aims to analyze the segment of published body of knowledge through summary, classifications. It helps to comparisons of prior studies, review of literature and theoretical articles. Simply says it is an overall view, of research already undertaken on a research problem in a particular field of study. It is a frame of the research process on a chosen topic by providing new ideas, concepts, methods, techniques and approaches. Review of related literature suggests new avenues of approaches to the solution of chosen problem.

For the present study an attempt has been made to review the existing literature on Alzheimer disease research literature through scientometric study to understand the theoretical, methodological issues surrounding the scientometric study of Alzheimer disease.

Gupta *et al.* (2011) have made an attempt to analyse dementia research output from India during 2002-11 through scientometric study. The results of the study show that of 25.58% during 2002-11. Its global publication share has increased over the years, rising from 0.54% in 2002 to 2.20% during 2011. Its citation impact per paper was 5.11 during 2002-11, which decreased from 7.29 during 2002-06 to 4.33 during 2007-11. Its international collaborative publications share was 24.54% during 2002-11, which decreased from 28.57% during 2002-06 to 23.07% during 2007-11. India's publications efforts are quiet low considering that to 3.7 million people suffering from dementia in India.

Chen *et al.*, (2014) have studied the Alzheimer's disease research in the future: bibliometric analysis of cholinesterase inhibitors from 1993 to 2012. The bibliometric study of cholinesterase inhibitors was used to find the trend of Alzheimer's disease (AD) research and the order of drugs which was most tolerated or more effective in AD treatment. 4,982 articles and reviews from the science. Citation Index Expanded during 1993–2012 was analyzed. A bibliometric study was performed on the articles related to ''cholinesterase inhibitor'' published from 1993 to 2012. Documents considered in this study

come from Science Citation Index-Expanded (SCI-E). Two mesh terms ''cholinesterase inhibitor'' and ''dementia'' already checked in PubMed mesh database were used to conduct searching titles, abstracts, and author keywords from 1993 to 2012 The results indicates that the publication of cholinesterase inhibitor research increased overall during 1993–2012. There were 5,358 publications that met the selection criteria mentioned earlier, including 11 document types. Articles (4,246) was the most frequently used document type, comprising 79.25 % of the total production which was relatively the highest with its h-index 96, USA tops the list, with a publications share of 29.69 % during 1993–2012. The number of scientific articles per category exhibited sustaining growth during the time period, 6,552 different author keywords were used from 1993 to 2012 Journal of Medicinal Chemistry ranking the top productive journal in two 10-year-times during 1993–2012. Chinese Academy of Science had most publications, University of California, San Diego and Hebrew University of Jerusalem won first place with the highest average citation per paper and the highest h-index respectively. Neurosciences, pharmacology and chemistry were ''raising'' subject categories in cholinesterase inhibitors research. The study gives the comprehensive analysis of distribution and change of author keywords in two 10-year-time periods.

Choi *et al.,* (2016) have conducted a bibliomertic study of research productivity of emergency medicine researchers in South Korea A total of 858 articles with 293 Korean authors as the first or corresponding authors were published across 191 journals. The number of publications increased continuously. The most common publication type was original article (n=618), the most commonly studied research topic was resuscitation medicine (n=110), and the average impact factor of the original articles was 2.158. The highest h-index was 17 and, using Web of Science, the maximum number of citations was found to be 85.

Nagalingam (2017) has conducted a study on the basis of a total of 14064 papers on Parkinson's disease research during the period understudy. Articles were found the most used document type with 10384 (73.83%) publications followed by reviews. It was found that documents with more than three authored papers occupied the 1st rank; the Parkinsonism and Related Disorders gets the maximum number of documents to be published with 411 (2.92%) titles in its share followed by PLoS One with 365 (2.60%) records and Neuroscience Letters with 258 (1.83%) and so on; Hattori, N. becomes the most productive author followed by Tan, E.K. China which is the leading country followed by Japan.

Alberto (2017). bibliometric and scientometric analyses of AD research reveal several interesting trends between 1975 and 2014. Based on PubMed search, the volume of papers has been continuously growing, with an even higher pace in the last 5 years analyzed. However, based on Scopus search, this ever-increasing rate of publications has not been paralleled by an increase in patents, because the number of patents per year peaked in 2007 and declined thereafter.

Alagarsamy and Ramalingam (2018) have examined growth and development of world literature on hemophilia in terms of publications output as per SCOPUS database (2003-2017). The results of the study indicate that the database included a total of 13503 papers were published between 2003-2017. The average number of publications published per year was 900. The highest number of publications 1095 was published in 2012. Out of 13503 contributions, only 18.48% (2495 papers) of single authored and rest of 11008 papers (81.52%) were multi authored. The study identifies active institutions and country-wise distributions of hemophilia research output. The yearly analysis of data shows that there is a rapid growth of literature from 2011 onwards. There were 126 countries involved in the research in this field. USA is the top producing country with 3986 authorships (29.52%) followed by United Kingdom

with 1438 authorships (10.65%). Still, in an international sense, relative productivity of India is low and requires more focused research and development.

Gupta *et al.,* (2018) have analyzed a total of 493 global dysgraphia research papers indexed in Scopus database during the last 10 years from 2007 to 2016 reflected in Scopus database. Citation impact is averaged to 7.90 citations per paper in 10 years period, which decreased from 12.65 to 3.92 from 2007-11 to 2012-16. Each of top 10 most productive countries in global dysgraphia research accounted for 3.04% to 20.69% global publication share during 2007-16, with USA accounting for the highest publication share (20.69%), Top 10 most productive countries together in dysgraphia research accounted for 81.34% global publication share and 96.74% global citation share during 2007-16. Medicine, among subjects, contributed the largest publication share (72.41%), the top 15 and 10 most productive organizations and authors together contributed 22.92% and 13.18% respectively as their share of global publication output and 33.50% and 17.27% respectively as their share of global citation output during 2007-16. The leading organizations in terms of research productivity were John Hopkins University, 93.51% of the total global output in dysgraphia research appeared in journals. Cortex was the most productive journal with 22 papers, only 17 publications registered high citations, in the range of 42 to 191 citations per paper.

9. Chapterization

The proposed research study will be divided into five chapters as follows:

Chapter-I: Introduction

The chapter will contain the introduction, the need for the study, Objectives, Statement of the problem, Scope and limitation of the study, Materials and methodology and Review of related literature.

Chapter-II: Review of Related Literature

The chapter will presents a comprehensive review of the related literature for the study in subhead: growth of literature, author productivity and collaborations, institutional productivity, journals productivity and obsolescence.

Chapter-III: Alzheimer's Disease : An Overview

The chapter will give bird's eye view on Alzheimer's disease.

Chapter-IV: Data Analysis and Interpretations

The chapter will provide the analysis of the data for proposed research study under five major heads: Growth and development; Author productivity and collaboration; Productivity of Journals; Productivity of Scientists and institutions and Obsolescence of Alzheimer's literature.

Chapter-V: Findings and Conclusion

The chapter will present a brief summary of the findings, areas of further research and conclusion.

10. Conclusion

Scientometric studies useful to the policy makers who are deciding the priority areas in certain domains and help in the analysis of R&D trends in identifying areas that are most active and those which are becoming important; identifying the influences and cross fertilizations. In Alzheimer's disease research bibliometric and scientometric analysis provides distinct trends, including publication and patent output, funding, impact, and topics. Findings of the study may help the policy makers for the decision-making of research funding agencies in the near future.

Bibliometric laws are very useful in understanding the communication pattern, information transfer, use which in term have several implication for libraries and information centres, especially in the research and development institutions. The ranking of journals is a new criterion for selection of science journals. This study will give a bird's eye view of the extent of research activities and research productivity on Alzheimer's disease.

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